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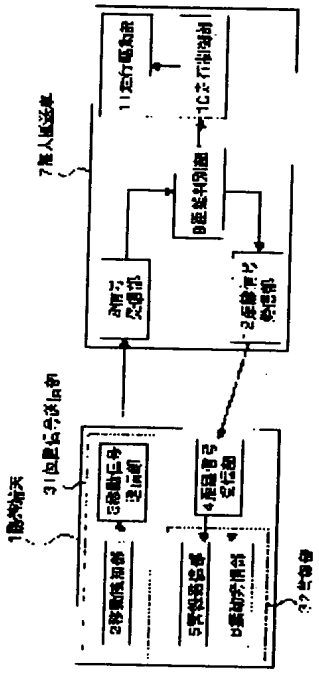
(54) SAFETY DEVICE FOR UNMANNED CARRIER SYSTEM

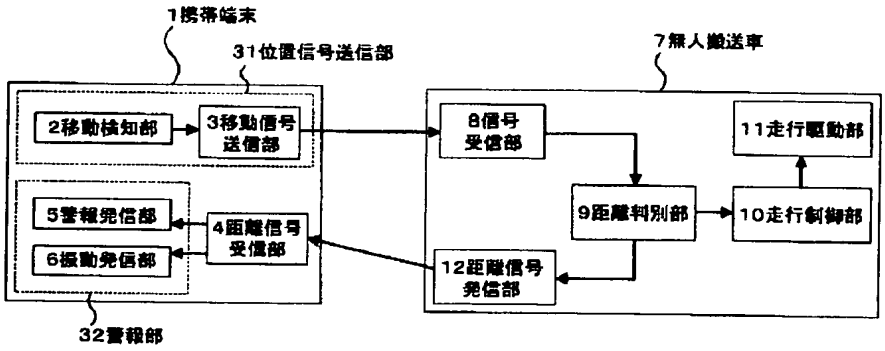


(57)Abstract:

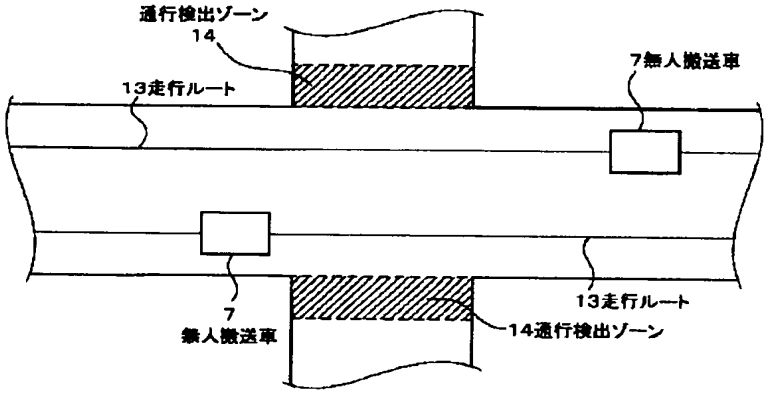
PROBLEM TO BE SOLVED: To solve the problem of a conventional unmanned carrier system that the traveling of an unmanned carrier is frequency affected since the unmanned carrier is stopped although an operator stands still when the radio receiver of the unmanned carrier receives a radio signal from a radio transmitter carried by the operator and that the danger of collision between the operator and the unmanned carrier is increased since the operation of the radio transmitter stops during the work when the life of the battery of the radio transmitter is shortened due to the continuous transmission of the radio signal from the radio transmitter carried by the operator.

SOLUTION: A portable terminal 1 carried by an operator detects the movement of an operator, and judges the distance between the operator and an unmanned carrier 7 only while operator is moving so that the traveling control of the unmanned carrier can be performed. Thus, it is possible to prevent any collision between the operator and the unmanned carrier by the obstacle sensor of the unmanned carrier 7 while the operator stands still, and to reduce any excessive traveling control of the unmanned carrier by the portable terminal 1 of the operator.

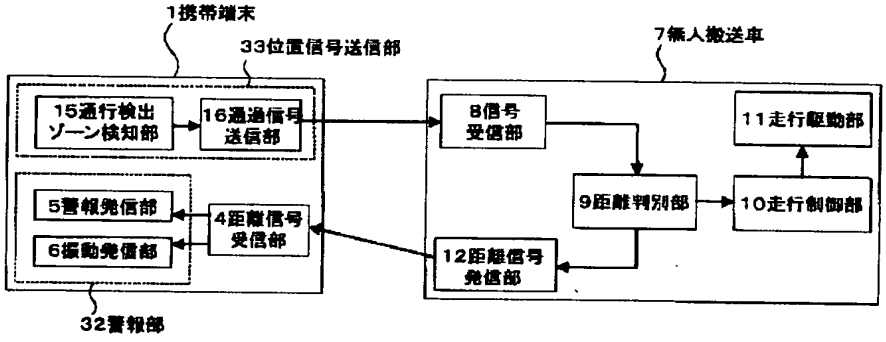
DRAWINGS



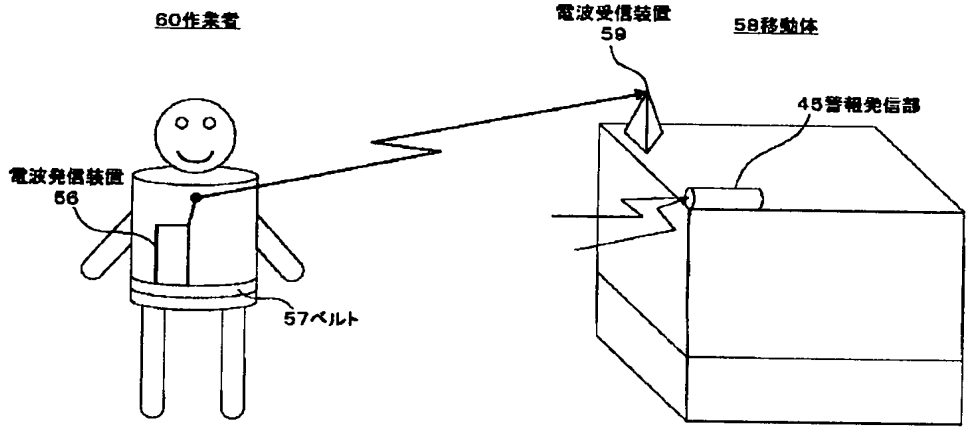
[Drawing 1]



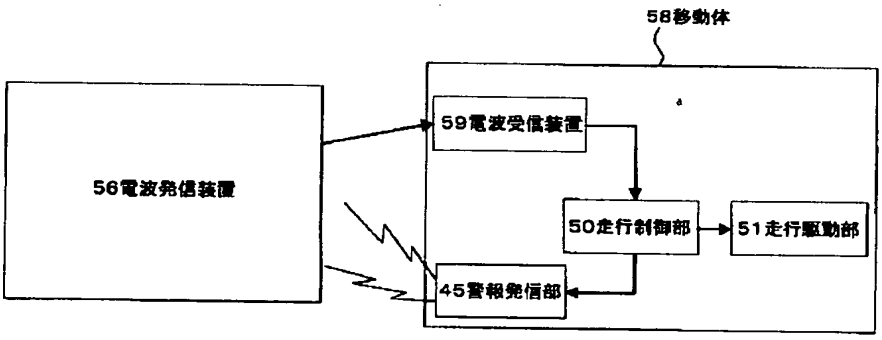
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Drawing 5]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the safety device which avoids efficiently the collision with an automatic guided vehicle and the obstruction which moves [operator] about the safety device of an automatic guided vehicle system.

[0002]

[Description of the Prior Art] Conventionally, the safety device of an automatic guided vehicle is used for the purpose of the collision prevention of automatic guided vehicles, and the collision prevention of an uninhabited conveyance person and an operator.

[0003] As a safety device of an automatic guided vehicle and an operator, the technique in which a halt of the traveller of a mobile and the alarm to an operator are emitted is indicated by JP,01-178688,U by receiving the signal from an electric-wave sender with the electric-wave sender which can be freely detached and attached on the body, and the electric-wave receiving set formed in mobiles, such as an automatic guided vehicle.

[0004] Drawing 4 is the block diagram showing an example of the conventional example. Drawing 5 is the block diagram of the conventional example.

[0005] First, an operator 60 is equipped with the electric-wave sender 56 which can be freely detached and attached on the body in belt 57 grade like drawing 4 . From the electric-wave sender 56, the electric-wave signal which tells an operator's 60 whereabouts is sent, and if the electric-wave receiving set 59 formed in the mobiles 58, such as an automatic guided vehicle, receives the electric-wave signal from the electric-wave sender 56, a signal will be transmitted to the transit control section 50 from the electric-wave receiving set 59 like drawing 5 . Then, by emitting a transit stop signal from the transit control section 50 to the transit mechanical component 51, a mobile 58 stops or an alarm is emitted by the operator 60 from an automatic guided vehicle by the alarm dispatch sections 45, such as a buzzer.

[0006]

[Problem(s) to be Solved by the Invention] However, this conventional technique had the following troubles.

[0007] That is, since an automatic guided vehicle will stop even when the operator is standing it still even if if the electric-wave receiving set of an automatic guided vehicle receives the electric-wave signal from the electric-wave sender which the operator carried, transit of an automatic guided vehicle will be influenced frequently.

[0008] Moreover, when the electric-wave signal was always sent from the electric-wave sender which the operator carried, the life of the dc-battery of an electric-wave sender became short, and there was also a problem that an electric-wave sender stopped operating and the danger of the collision with an automatic guided vehicle will increase during an activity.

[0009] The purpose of this invention is to offer the safety device of the automatic guided vehicle system

which can prevent the collision with an operator, without an automatic guided vehicle carrying out useless actuation.

[0010]

[Means for Solving the Problem] The safety device of the 1st automatic guided vehicle system of this invention It is the safety device of the automatic guided vehicle system which avoids the collision with an automatic guided vehicle and an obstruction. Said automatic guided vehicle The signal receive section which receives the signal sent from said obstruction, and the distance distinction section which computes the distance of said obstruction and said automatic guided vehicle in response to the signal from said signal receive section, The transit control section which controls a travel speed in response to the signal from said distance distinction section, The distance signal dispatch section which outputs the signal which tells the distance of said obstruction and said automatic guided vehicle in response to the signal from said distance distinction section, It has the transit mechanical component which sets up the travel speed of said automatic guided vehicle in response to the control signal from said transit control section. Said obstruction With the position signal transmitting section which sends the signal which tells the location of said obstruction, and the distance signal receive section which receives the signal from said distance signal dispatch section The migration detection section which detects that have equipped the insurance device containing the alarm part which emits an alarm in response to the signal from said distance signal receive section, and said obstruction is moving [said position signal transmitting section], It is characterized by having the migration signal transmitting section which sends the signal which tells that said obstruction is moving in response to the signal from said migration detection section.

[0011] Next, the safety device of the 2nd automatic guided vehicle system of this invention It is the safety device of the automatic guided vehicle system which avoids the collision with an automatic guided vehicle and an obstruction. Said automatic guided vehicle The signal receive section which receives the signal sent from said obstruction, and the distance distinction section which computes the distance of said obstruction and said automatic guided vehicle in response to the signal from said signal receive section, The transit control section which controls a travel speed in response to the signal from said distance distinction section, The distance signal dispatch section which outputs the signal which tells the distance of said obstruction and said automatic guided vehicle in response to the signal from said distance distinction section, It has the transit mechanical component which sets up the travel speed of said automatic guided vehicle in response to the control signal from said transit control section. Said obstruction With the position signal transmitting section which sends the signal which tells the location of said obstruction, and the distance signal receive section which receives the signal from said distance signal dispatch section The insurance device containing the alarm part which emits an alarm in response to the signal from said distance signal receive section is equipped. When said position signal transmitting section passes through the passing detection zone in which said obstruction was prepared near the transit root of said automatic guided vehicle in the direction of said transit root The passing detection zone detection section which receives the passage signal sent from the sensor formed in said passing detection zone, It is characterized by having the passage signal transmitting section which sends the signal which tells that said obstruction passed through said passing detection zone in response to the signal from said passing detection zone detection section.

[0012] In the safety device of the above 1st and the 2nd automatic guided vehicle system said automatic guided vehicle Said signal receive section, said distance distinction section, said transit control section, said distance signal dispatch section, It has the obstruction detection signal dispatch section which sends the obstruction detection signal for detecting the obstruction other than said transit mechanical component, and the obstruction detection signal receive section which receives the reflective signal of said obstruction detection signal. The reflective signal which said obstruction detection signal reflects in an obstruction is received in said obstruction detection signal receive section. Said distance distinction section computes the distance of said obstruction and said automatic guided vehicle by said distance distinction section in response to the signal from said obstruction detection signal receive section, and when said distance is less than a

predetermined value Transmit a control signal to said transit control section, and drive said transit mechanical component, and the transit direction of said automatic guided vehicle is changed so that said obstruction may be avoided. Besides the alarm dispatch section in which is equipped with the function to stop said automatic guided vehicle, and said alarm part emits an alarm in response to the signal from said distance signal receive section It has the oscillating dispatch section which tells said obstruction about risk. Said oscillating dispatch section It has the function to change the amplitude of the vibration according to the signal from said distance signal dispatch section. Moreover, it has the function to change the frequency of the vibration according to the signal from said distance signal dispatch section, and said alarm dispatch section has the function to change the sound volume of the alarm tone according to the signal from said distance signal dispatch section.

[0013]

[Embodiment of the Invention] The safety device of the automatic guided vehicle by this invention is a safety device which detects the electric-wave signal sent from the personal digital assistant which detects migration of obstructions, such as an operator, by the automatic guided vehicle, distinguishes distance by the strength of an electric wave, and prevents a collision by transit control of an automatic guided vehicle. Especially while it has the description at the point that the electric-wave signal that an operator is moving is sent, from the personal digital assistant 1 in drawing 1 when an operator's personal digital assistant 1 detects migration of an operator, and the operator is standing it still, an electric-wave signal is not sent from a personal digital assistant 1. After an electric-wave signal is sent from a personal digital assistant 1, an electric-wave signal is received by the automatic guided vehicle 7, distance is distinguished, approach of an operator is detected, and transit control of an automatic guided vehicle 7 is performed. A signal is sent, a personal digital assistant 1 receives the signal, and the automatic guided vehicle 7 which detected approach of an operator emits an alarm and vibration.

[0014] First, although the 1st operation gestalt of this invention is explained with reference to the block diagram of drawing 1 If an operator is detected by the obstruction sensor (illustration abbreviation) when the automatic guided vehicle has the function which detects a front obstruction by the obstruction sensor and the operator has stopped on the transit root of an automatic guided vehicle, this invention Since transit control and a halt are performed according to the distance, it is premised on the conditions that the migration signal from a personal digital assistant is especially unnecessary. This is for attaining power-saving of a personal digital assistant by not sending a migration signal from a personal digital assistant, when the operator is not moving.

[0015] First, an operator's personal digital assistant 1 is divided roughly, and consists of the position signal transmitting section 31, a distance signal receive section 4, and an alarm part 32, further, the position signal transmitting section 31 consists of the migration detection section 2 which detects migration by the existence of vibration by walk of an operator etc., and the migration signal transmitting section 3 which sends an electric-wave signal, and an alarm part 32 consists of the alarm dispatch section 5 and the oscillating dispatch section 6. Moreover, an alarm part 32 will perform dispatch of an alarm and vibration, if the signal from an automatic guided vehicle 7 is received in the distance signal receive section 4.

[0016] Next, an automatic guided vehicle 7 has the signal receive section 8 which receives the electric-wave signal from a personal digital assistant 1, and the distance distinction section 9, performs transit control according to distance by the transit control section 10, and sends the electric-wave signal for making an operator's personal digital assistant 1 generate an alarm from the distance signal dispatch section 12.

[0017] If an operator's vibration is detected in the migration detection section 2 of the personal digital assistant 1 which the operator has equipped, it will judge that an operator is moving, and the electric-wave signal of a specific frequency will be turned and sent to an automatic guided vehicle 7 from the migration transmitting section 3. The sent electric-wave signal is received in the signal receive section 8 of an automatic guided vehicle 7, distance is distinguished by the distance distinction section 9, and moderation of an automatic guided vehicle 7 and control of a halt are performed by sending a transit control signal to the

transit mechanical component 11 from the transit control section 10. Moreover, from an automatic guided vehicle 7, according to distance with an operator, a specific electric-wave signal is sent from the signal dispatch section 12, and if the electric-wave signal is received in the receive section 4 of an operator's personal digital assistant 1, according to a signal, vibration will be generated in dispatch of an alarm and the oscillating dispatch section 6 in the alarm dispatch section 5.

[0018] Next, actuation of drawing 1 is explained.

[0019] First, migration is detected by vibration at the time of a walk in the migration detection section 2 of the personal digital assistant 1 which an operator equips as a means to detect that the operator is moving, and the signal of migration is transmitted as an electric-wave signal from the transmitting section 3. An automatic guided vehicle 7 distinguishes the size of distance for the received electric-wave signal by the distance distinction section 9 detects approach of an operator, performs control of delivery and the transit mechanical component 11 f[illegible] signal to the transit control section 10 according to distance with an operator, and performs moderation and a halt of an automatic guided vehicle 7. Moreover, the electric-wave signal which tells distance with an automatic guided vehicle 7 to a personal digital assistant 1 from the dispatch section 12 according to distance with the operator who distinguished in the distance distinction section 9 is transmitted. On the other hand, the alarm dispatch section 5 in which the personal digital assistant 1 which received the electric-w[illegible]om ar[illegible]matic guided vehicle 7 received the signal from a receive section 4 sends an alarm tone, and the os[illegible] dispatch section 6 generates vibration. The alarm dispatch section 5 and the oscillating dispatch section 6 become classifiable according to distance by changing the size and spacing of an alarm tone by the partition of a signal, and changing the strength and the class of vibration.

[0020] Since distance distinction with an operator and an automatic guided vehicle is performed and transit control of an automatic guided vehicle is performed only while the personal digital assistant which an operator possesses f an operator first as the 1st effectiveness of this invention and an operator is moving, w[illegible]e an operat[illegible]tands it still, the collision with an operator and an automatic guided vehicle will be avoided by the obstruction sensor of an automatic guided vehicle, and it is effective in reducing excessive transit control of the automatic guided vehicle by an operator's personal digital assistant. Moreover, since a personal digital assistant does not operate while an operator stands it still, it is effective in the ability to lengthen the life of a personal digital assistant of operation.

[0021] Next, it is being able to prevent useless moderation and a useless halt of an automatic guided vehicle by making approach of the operator who is moving to the automatic guided vehicle detect as the 2nd effectiveness. The operator whom the reason is not moving is not influenced of the operator who is not moving by excepting in order not to run out on the transit root of an automatic guided vehicle. In this case, about the obstruction on the transit root of an automatic guided vehicle, it detects by the obstruction sensor, transit control is performed, and it is uninfluential to an operator's insurance.

[0022] Next, as the 3rd effectiveness, by making approach of an automatic guided vehicle recognize to an operator certainly by the alarm and vibration, attention is called and collision prevention with an automatic guided vehicle can be planned. The reason makes approach of an automatic guided vehicle detect by both the alarm and vibration, and can recognize the degree of approach with an automatic guided vehicle according to the size of an alarm, spacing, and the strength and class of vibration.

[0023] The impact at the time of evasion of a collision and a collision can be reduced by finally performing transit control which detected migration of an operator as the 4th effectiveness. Since the reason has slowed down or stopped the automatic guided vehicle by speed control when an operator approaches, an operator tends to avoid contact, and even when it collides, its impact is small and it ends.

[0024] Next, the 2nd operation gestalt of this invention is explained with reference to drawing 3 and 4.

[0025] First, the passing detection zone 14 is established in the both sides of the transit root 13 of an automatic guided vehicle 7 as a means to detect migration of an operator, if an operator goes into the passing detection zone 14, the sensor formed in the passing detection zone 14 will operate, and the signal told [that the operator entered to the passing detection zone 14 in the passing detection zone detection section 15 of an

operator's personal digital assistant 1 and] will be transmitted. Then, a signal is sent to the passage signal transmitting section 16 from the passing detection zone detection section 15 of an operator's personal digital assistant 1, and an electric-wave signal is sent towards the signal receive section 8 of an automatic guided vehicle 7 from the passage signal transmitting section 16. In this case, it not only distinguishes the distance of an operator and an automatic guided vehicle like the 1st operation gestalt, but it has the new effectiveness that it is detectable which partition requires an operator, by setting up the partition every passing detection zone 14.

[0026] In explanation of the operation gestalt of the above this invention, although the safety system of an automatic guided vehicle and an operator was explained, it cannot be overemphasized instead of an operator that you may be a robot, the obstruction which moves.

[0027]

[Effect of the Invention] As mentioned above, since the safety device of the automatic guided vehicle system of this invention performs distance distinction with an operator and an automatic guided vehicle and performs transit control of an automatic guided vehicle only while the personal digital assistant which an operator possesses detects migration of an operator and an operator is moving, while an operator stands it still, it will avoid the collision with an operator and an automatic guided vehicle by the obstruction sensor of an automatic guided vehicle, and is effective in reducing excessive transit control of the automatic guided vehicle by an operator's personal digital assistant. Moreover, since a personal digital assistant does not operate while an operator stands it still, it is effective in the ability to lengthen the life of a personal digital assistant of operation.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the safety device of the automatic guided vehicle system of the 1st operation gestalt of this invention.

[Drawing 2] It is the plan showing the activity floor for explaining the safety device of the automatic guided vehicle system of the 2nd operation gestalt of this invention.

[Drawing 3] It is the block diagram showing the safety device of the automatic guided vehicle system of the 2nd operation gestalt of this invention.

[Drawing 4] It is sketch drawing for explaining the conventional automatic guided vehicle system.

[Drawing 5] It is the block diagram showing the safety device of the conventional automatic guided vehicle system.

[Description of Notations]

1 Personal Digital Assistant
2 Migration Detection Section
3 Migration Signal Transmitting Section
4 Distance Signal Receive Section
5 45 Alarm dispatch section
6 Oscillating Dispatch Section
7 Automatic Guided Vehicle
8 Signal Receive Section
9 Distance Distinction Section
10 50 Transit control section
11 51 Transit mechanical component
12 Distance Signal Dispatch Section
13 Transit Root

14 Passing Detection Zone
15 Passing Detection Zone Detection Section
16 Passage Signal Transmitting Section
31 33 Position signal transmitting section
32 Alarm Part
56 Electric-Wave Sender
57 Belt
58 Mobile
59 Electric-Wave Receiving Set
60 Operator

CLAIMS

[Claim(s)]

[Claim 1] It is the safety device of the automatic guided vehicle system which avoids the collision with an automatic guided vehicle and an obstruction. Said automatic guided vehicle The signal receive section which receives the signal sent from said obstruction, and the distance distinction section which computes the distance of said obstruction and said automatic guided vehicle in response to the signal from said signal receive section, The transit control section which controls a travel speed in response to the signal from said distance distinction section, The distance signal dispatch section which outputs the signal which tells the distance of said obstruction and said automatic guided vehicle in response to the signal from said distance distinction section, It has the transit mechanical component which sets up the travel speed of said automatic guided vehicle in response to the control signal from said transit control section. Said obstruction With the position signal transmitting section which sends the signal which tells the location of said obstruction, and the distance signal receive section which receives the signal from said distance signal dispatch section The migration detection section which detects that have equipped the insurance device containing the alarm part which emits an alarm in response to the signal from said distance signal receive section, and said obstruction is moving [said position signal transmitting section], The safety device of the automatic guided vehicle system characterized by having the migration signal transmitting section which sends the signal which tells that said obstruction is moving in response to the signal from said migration detection section.

[Claim 2] It is the safety device of the automatic guided vehicle system which avoids the collision with an automatic guided vehicle and an obstruction. Said automatic guided vehicle The signal receive section which receives the signal sent from said obstruction, and the distance distinction section which computes the distance of said obstruction and said automatic guided vehicle in response to the signal from said signal receive section, The transit control section which controls a travel speed in response to the signal from said distance distinction section, The distance signal dispatch section which outputs the signal which tells the distance of said obstruction and said automatic guided vehicle in response to the signal from said distance distinction section, It has the transit mechanical component which sets up the travel speed of said automatic guided vehicle in response to the control signal from said transit control section. Said obstruction With the position signal transmitting section which sends the signal which tells the location of said obstruction, and the distance signal receive section which receives the signal from said distance signal dispatch section The insurance device containing the alarm part which emits an alarm in response to the signal from said distance signal receive section is equipped. When said position signal transmitting section passes through the passing detection zone in which said obstruction was prepared near the transit root of said automatic guided vehicle in the direction of said transit root The passing detection zone detection section which receives the passage signal sent from the sensor formed in said passing detection zone, The safety device of the automatic guided vehicle system characterized by having the passage signal transmitting section which sends the signal which

tells that said obstruction passed through said passing detection zone in response to the signal from said passing detection zone detection section.

[Claim 3] Said automatic guided vehicle Said signal receive section, said distance distinction section, said transit control section, It has the obstruction detection signal dispatch section which sends the obstruction detection signal for detecting the obstruction other than said distance signal dispatch section and said transit mechanical component, and the obstruction detection signal receive section which receives the reflective signal of said obstruction detection signal. The reflective signal which said obstruction detection signal reflects in an obstruction is received in said obstruction detection signal receive section. Said distance distinction section computes the distance of said obstruction and said automatic guided vehicle by said distance distinction section in response to the signal from said obstruction detection signal receive section, and when said distance is less than a predetermined value The safety device of the automatic guided vehicle system according to claim 1 or 2 which transmits a control signal to said transit control section, drives said transit mechanical component, changes the transit direction of said automatic guided vehicle so that said obstruction may be avoided, or stops said automatic guided vehicle.

[Claim 4] The safety device of the automatic guided vehicle system according to claim 1, 2, or 3 which has the oscillating dispatch section which tells said obstruction other than the alarm dispatch section in which said alarm part emits an alarm in response to the signal from said distance signal receive section about risk.

[Claim 5] Said oscillating dispatch section is the safety device of the automatic guided vehicle system according to claim 4 to which the amplitude of the vibration is changed according to the signal from said distance signal dispatch section.

[Claim 6] Said oscillating dispatch section is the safety device of the automatic guided vehicle system according to claim 4 or 5 to which the frequency of the vibration is changed according to the signal from said distance signal dispatch section.

[Claim 7] Said alarm dispatch section is the safety device of the automatic guided vehicle system according to claim 4, 5, or 6 to which the sound volume of the alarm tone is changed according to the signal from said distance signal dispatch section.

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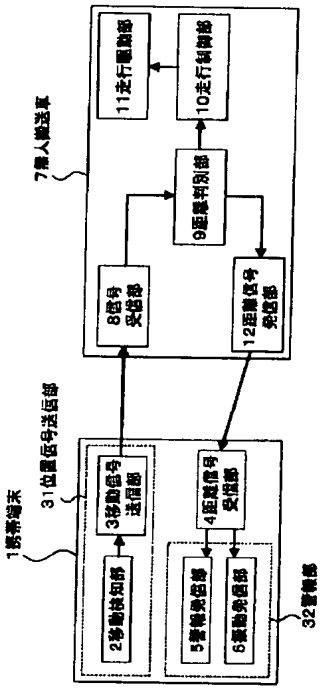
(54)【発明の名称】　無人搬送車システムの安全装置

(57)【要約】
【課題】従来の無人搬送車システムにおいては、作業者の装着した電波発信装置からの電波信号を無人搬送車の電波受信装置が受信すると、たとえ作業者が静止している場合でも無人搬送車が停止するため、無人搬送車の走行が頻繁に影響を受け、また、作業者の装着した電波発信装置から常時電波信号を発信していると、電波発信装置のバッテリーの寿命が短くなり、作業中に電波発信装置が動作しなくなって無人搬送車との衝突の危険性が増大してしまうという問題があった。
【解決手段】作業者の所持する携帯端末１が、作業者の移動を検知して、作業者が移動中である間のみ作業者と無人搬送車７との距離判別を行って無人搬送車の走行制御を行うので、作業者が静止中は無人搬送車７の障害物センサーにより作業者と無人搬送車との衝突を回避することとなり、作業者の携帯端末１による無人搬送車の余計な走行制御を減らすという効果がある。



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【特許請求の範囲】

【請求項１】　無人搬送車と障害物との衝突を回避する無人搬送車システムの安全装置であって、前記無人搬送車は、前記障害物から発信される信号を受信する信号受信部と、前記信号受信部からの信号を受けて前記障害物と前記無人搬送車との距離を算出する距離判別部と、前記距離判別部からの信号を受けて走行速度を制御する走行制御部と、前記距離判別部からの信号を受けて前記障害物と前記無人搬送車との距離を知らせる信号を出力する距離信号発信部と、前記走行制御部からの制御信号を受けて前記無人搬送車の走行速度を設定する走行駆動部とを有し、前記障害物は、前記障害物の位置を知らせる信号を発信する位置信号送信部と、前記距離信号発信部からの信号を受信する距離信号受信部と、前記距離信号受信部からの信号を受けて警報を発する警報部とを含む安全機器を装備しており、前記位置信号送信部が、前記障害物が移動中であることを検知する移動検知部と、前記移動検知部からの信号を受けて前記障害物が移動中であることを伝える信号を発信する移動信号送信部とを有することを特徴とする無人搬送車システムの安全装置。

【請求項２】　無人搬送車と障害物との衝突を回避する無人搬送車システムの安全装置であって、前記無人搬送車は、前記障害物から発信される信号を受信する信号受信部と、前記信号受信部からの信号を受けて前記障害物と前記無人搬送車との距離を算出する距離判別部と、前記距離判別部からの信号を受けて走行速度を制御する走行制御部と、前記距離判別部からの信号を受けて前記障害物と前記無人搬送車との距離を知らせる信号を出力する距離信号発信部と、前記走行制御部からの制御信号を受けて前記無人搬送車の走行速度を設定する走行駆動部とを有し、前記障害物は、前記障害物の位置を知らせる信号を発信する位置信号送信部と、前記距離信号発信部からの信号を受信する距離信号受信部と、前記距離信号受信部からの信号を受けて警報を発する警報部とを含む安全機器を装備しており、前記位置信号送信部が、前記障害物が前記無人搬送車の走行ルート近傍に設けられた通行検出ゾーンを前記走行ルートの方向に通過したときに、前記通行検出ゾーンに設けられたセンサーから発信された通過信号を受信する通行検出ゾーン検知部と、前記通行検出ゾーン検知部からの信号を受けて前記障害物が前記通行検出ゾーンを通過したことを伝える信号を発信する通過信号送信部とを有することを特徴とする無人搬送車システムの安全装置。

【請求項３】　前記無人搬送車は、前記信号受信部、前記距離判別部、前記走行制御部、前記距離信号発信部、前記走行駆動部の他に、障害物を検知するための障害物検知信号を発信する障害物検知信号発信部と前記障害物検知信号の反射信号を受信する障害物検知信号受信部とを有しており、前記障害物検知信号が障害物に当たって反射する反射信号を前記障害物検知信号受信部で受信

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し、前記障害物検知信号受信部からの信号を前記距離判別部が受けて前記距離判別部により前記障害物と前記無人搬送車との距離を算出し、前記距離が所定の値以内のときに、前記走行制御部に制御信号を送信して前記走行駆動部を駆動し、前記障害物を避けるように前記無人搬送車の走行方向を変える、或いは、前記無人搬送車を停止する請求項１又は２記載の無人搬送車システムの安全装置。

【請求項４】　前記警報部が、前記距離信号受信部からの信号を受けて警報を発する警報発信部の他に、前記障害物に危険を知らせる振動発信部を有する請求項１、２又は３記載の無人搬送車システムの安全装置。

【請求項５】　前記振動発信部は、前記距離信号発信部からの信号に応じてその振動の振幅を変化させる請求項４記載の無人搬送車システムの安全装置。

【請求項６】　前記振動発信部は、前記距離信号発信部からの信号に応じてその振動の周波数を変化させる請求項４又は５記載の無人搬送車システムの安全装置。

【請求項７】　前記警報発信部は、前記距離信号発信部からの信号に応じてその警報音の音量を変化させる請求項４、５又は６記載の無人搬送車システムの安全装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、無人搬送車システムの安全装置に関し、特に、無人搬送車と作業者等の移動する障害物との衝突を効率的に回避する安全装置に関するものである。

【０００２】

【従来の技術】従来、無人搬送車の安全装置は、無人搬送車どうしの衝突防止および無人搬送者と作業者の衝突防止を目的として用いられている。

【０００３】無人搬送車と作業者との安全装置として、たとえば実開平０１－１７８６８８号公報には、人体に着脱自在な電波発信装置と無人搬送車などの移動体に設けられた電波受信装置により、電波発信装置からの信号を受信することにより、移動体の走行装置の停止と作業者への警報が発せられる技術が記載されている。

【０００４】図４は従来の実施例の一例を示す構成図である。図５は、従来の実施例のブロック図である。

【０００５】まず、図４のように、人体に着脱自在な電波発信装置５６は、ベルト５７等で作業者６０に装着される。電波発信装置５６からは作業者６０の所在を知らせる電波信号が発信され、無人搬送車などの移動体５８に設けられた電波受信装置５９で電波発信装置５６からの電波信号を受信すると、図５のように、電波受信装置５９から走行制御部５０へ信号を送信する。続いて、走行制御部５０から走行駆動部５１に走行停止信号を発することにより移動体５８が停止する、或いは、ブザーなどの警報発信部４５により無人搬送車から作業者６０に警報が発せられる。

【０００６】
【発明が解決しようとする課題】しかし、この従来技術は次のような問題点があった。
【０００７】即ち、作業者の装着した電波発信装置からの電波信号を無人搬送車の電波受信装置が受信すると、たとえ作業者が静止している場合でも無人搬送車が停止するため、無人搬送車の走行が頻繁に影響を受けてしまう。
【０００８】また、作業者の装着した電波発信装置から常時電波信号を発信していると、電波発信装置のバッテリーの寿命が短くなり、作業中に電波発信装置が動作しなくなって無人搬送車との衝突の危険性が増大してしまうといった問題もあった。
【０００９】本発明の目的は、無人搬送車が無駄な動作をすることなく、作業者との衝突を防止できる無人搬送車システムの安全装置を提供することにある。
【００１０】
【課題を解決するための手段】本発明の第１の無人搬送車システムの安全装置は、無人搬送車と障害物との衝突を回避する無人搬送車システムの安全装置であって、前記無人搬送車は、前記障害物から発信される信号を受信する信号受信部と、前記信号受信部からの信号を受けて前記障害物と前記無人搬送車との距離を算出する距離判別部と、前記距離判別部からの信号を受けて走行速度を制御する走行制御部と、前記距離判別部からの信号を受けて前記障害物と前記無人搬送車との距離を知らせる信号を出力する距離信号発信部と、前記走行制御部からの制御信号を受けて前記無人搬送車の走行速度を設定する走行駆動部とを有し、前記障害物は、前記障害物の位置を知らせる信号を発信する位置信号送信部と、前記距離信号発信部からの信号を受信する距離信号受信部と、前記距離信号受信部からの信号を受けて警報を発する警報部とを含む安全機器を装備しており、前記位置信号送信部が、前記障害物が移動中であることを検知する移動検知部と、前記移動検知部からの信号を受けて前記障害物が移動中であることを伝える信号を発信する移動信号送信部とを有することを特徴とする。
【００１１】次に、本発明の第２の無人搬送車システムの安全装置は、無人搬送車と障害物との衝突を回避する無人搬送車システムの安全装置であって、前記無人搬送車は、前記障害物から発信される信号を受信する信号受信部と、前記信号受信部からの信号を受けて前記障害物と前記無人搬送車との距離を算出する距離判別部と、前記距離判別部からの信号を受けて走行速度を制御する走行制御部と、前記距離判別部からの信号を受けて前記障害物と前記無人搬送車との距離を知らせる信号を出力する距離信号発信部と、前記走行制御部からの制御信号を受けて前記無人搬送車の走行速度を設定する走行駆動部とを有し、前記障害物は、前記障害物の位置を知らせる信号を発信する位置信号送信部と、前記距離信号発信部からの信号を受信する距離信号受信部と、前記距離信号受信部からの信号を受けて警報を発する警報部とを含む安全機器を装備しており、前記位置信号送信部が、前記障害物が前記無人搬送車の走行ルート近傍に設けられた通行検出ゾーンを前記走行ルートの方向に通過したときに、前記通行検出ゾーンに設けられたセンサーから発信された通過信号を受信する通行検出ゾーン検知部と、前記通行検出ゾーン検知部からの信号を受けて前記障害物が前記通行検出ゾーンを通過したことを伝える信号を発信する通過信号送信部とを有することを特徴とする。
【００１２】上記第１、第２の無人搬送車システムの安全装置において、前記無人搬送車は、前記信号受信部、前記距離判別部、前記走行制御部、前記距離信号発信部、前記走行駆動部の他に、障害物を検知するための障害物検知信号を発信する障害物検知信号発信部と前記障害物検知信号の反射信号を受信する障害物検知信号受信部とを有しており、前記障害物検知信号が障害物に当たって反射する反射信号を前記障害物検知信号受信部で受信し、前記障害物検知信号受信部からの信号を前記距離判別部が受けて前記距離判別部により前記障害物と前記無人搬送車との距離を算出し、前記距離が所定の値以内のときに、前記走行制御部に制御信号を送信して前記走行駆動部を駆動し、前記障害物を避けるように前記無人搬送車の走行方向を変える、或いは、前記無人搬送車を停止する、という機能を備え、前記警報部が、前記距離信号受信部からの信号を受けて警報を発する警報発信部の他に、前記障害物に危険を知らせる振動発信部を有し、前記振動発信部は、前記距離信号発信部からの信号に応じてその振動の振幅を変化させる機能を有し、また、前記距離信号発信部からの信号に応じてその振動の周波数を変化させる機能を有し、また、前記警報発信部は、前記距離信号発信部からの信号に応じてその警報音の音量を変化させる機能を有している。
【００１３】
【発明の実施の形態】本発明による無人搬送車の安全装置は、作業者等の障害物の移動を検出する携帯端末から発信された電波信号を無人搬送車で検知し、電波の強さにより距離を判別し、無人搬送車の走行制御により衝突を防止する安全装置である。特に、図１において、作業者の携帯端末１で作業者の移動を検出したときに、携帯端末１から作業者が移動中であるという電波信号が発信される、という点に特徴を有しており、作業者が静止しているときは、電波信号は携帯端末１からは発信されない。携帯端末１から電波信号が発信された後、電波信号を無人搬送車７で受信し、距離を判別し、作業者の接近を検知し、無人搬送車７の走行制御を行う。作業者の接近を検知した無人搬送車７は、信号を発信し、その信号を携帯端末１が受信し警報及び振動を発する。
【００１４】まず、本発明の第１の実施形態について、図１のブロック図を参照して説明するが、本発明は、無

人搬送車は、障害物センサーにより前方の障害物を検知する機能を有しており、作業者が無人搬送車の走行ルート上で停止している場合、障害物センサー（図示省略）で作業者を検知すると、その距離に応じ走行制御及び停止を行うので、携帯端末からの移動信号は特に必要ない、という条件を前提としている。これは、作業者が移動していない場合に携帯端末から移動信号を発信しないことにより、携帯端末の省電力化を図るためである。

【００１５】まず、作業者の携帯端末１は、大別して、位置信号送信部３１、距離信号受信部４、警報部３２からなり、さらに、位置信号送信部３１は、作業者の歩行などによる振動の有無により移動を検知する移動検知部２と、電波信号を発信する移動信号送信部３とからなり、警報部３２は、警報発信部５及び振動発信部６からなる。また、警報部３２は、無人搬送車７からの信号を距離信号受信部４で受信すると、警報及び振動の発信を行う。

【００１６】次に、無人搬送車７は、携帯端末１からの電波信号を受信する信号受信部８と距離判別部９を有し、走行制御部１０で距離に応じた走行制御を行い、距離信号発信部１２より作業者の携帯端末１に警報を発生させるための電波信号を発信する。

【００１７】作業者が装備している携帯端末１の移動検知部２で作業者の振動を検出すると、作業者が移動中であることを判断し、移動送信部３から特定の周波数の電波信号を無人搬送車７に向けて発信する。発信された電波信号が無人搬送車７の信号受信部８で受信され、距離判別部９により距離を判別し、走行制御部１０より走行制御信号が走行駆動部１１に発信されることにより無人搬送車７の減速及び停止の制御を行う。また、無人搬送車７からは作業者との距離に応じて信号発信部１２より特定の電波信号が発信され、作業者の携帯端末１の受信部４でその電波信号を受信すると信号に応じて警報発信部５で警報の発信及び振動発信部６で振動を発生する。

【００１８】次に、図１の動作について説明する。

【００１９】まず、作業者が移動していることを検知する手段として作業者の装備する携帯端末１の移動検知部２で歩行時の振動により移動を検知し、移動の信号を送信部３より電波信号として送信する。無人搬送車７は、受信した電波信号を距離判別部９により距離の大小を判別し作業者の接近を検知し、作業者との距離に応じて走行制御部１０に信号を送り、走行駆動部１１の制御を行い無人搬送車７の減速及び停止を行う。また、距離判別部９で判別した作業者との距離に応じて発信部１２より携帯端末１に無人搬送車７との距離を伝える電波信号を送信する。一方、無人搬送車７からの電波信号を受信した携帯端末１は、受信部４からの信号を受けた警報発信部５が警報音を発信し、振動発信部６は振動を発生させる。警報発信部５および振動発信部６は、信号の区分により警報音の大小及び間隔を変化させ、また振動の強弱及び種類を変化させることにより距離に応じた区分が可能となる。

【００２０】本発明の第１の効果として、まず、作業者の所持する携帯端末が、作業者の移動を検知して、作業者が移動中である間のみ作業者と無人搬送車との距離判別を行って無人搬送車の走行制御を行うので、作業者が静止中は無人搬送車の障害物センサーにより作業者と無人搬送車との衝突を回避することとなり、作業者の携帯端末による無人搬送車の余計な走行制御を減らすという効果がある。また、作業者が静止中は携帯端末が動作しないので携帯端末の動作寿命を長くすることができるという効果もある。

【００２１】次に、第２の効果として、無人搬送車に移動している作業者の接近を検知させることにより、無人搬送車の無駄な減速や停止が防止できることである。その理由は、移動していない作業者は無人搬送車の走行ルート上に飛び出すことが無いため、除外することにより移動していない作業者の影響を受けない。この場合、無人搬送車の走行ルート上の障害物については、障害物センサーで検知して走行制御を行っており作業者の安全に影響はない。

【００２２】次に、第３の効果として、無人搬送車の接近を警報および振動により確実に作業者へ認識させることにより、注意を喚起し無人搬送車との衝突防止が図れる。その理由は、警報および振動の両方で無人搬送車の接近を検知させ、警報の大小や間隔、振動の強さや種類により無人搬送車との接近の度合いを認識できる。

【００２３】最後に、第４の効果として、作業者の移動を検知した走行制御を行うことにより、衝突の回避および衝突時の衝撃を低減することができる。その理由は、無人搬送車は作業者が接近するとき速度制御により減速または停止しているため、作業者が接触を回避しやすく、また衝突した場合でも衝撃が小さくてすむ。

【００２４】次に、本発明の第２の実施形態について図３、４を参照して説明する。

【００２５】まず、作業者の移動を検知する手段として無人搬送車７の走行ルート１３の両側に通行検出ゾーン１４が設けられており、作業者がその通行検出ゾーン１４に入ると、通行検出ゾーン１４に設けられたセンサが作動し、作業者の携帯端末１の通行検出ゾーン検知部１５に作業者が通行検出ゾーン１４に入ったことを知らせる信号を送信する。この後、作業者の携帯端末１の通行検出ゾーン検知部１５から通過信号送信部１６に信号が送られ、通過信号送信部１６から無人搬送車７の信号受信部８に向けて電波信号が発信される。この場合、第１の実施形態と同様に作業者と無人搬送車との距離を判別するだけでなく、通行検出ゾーン１４毎に区分を設定しておくことにより、作業者がどの区分にいるかも検知できるという新たな効果を有する。

【００２６】以上の本発明の実施形態の説明において

は、無人搬送車と作業者との安全システムについて説明したが、作業者の代わりに、ロボット、移動する障害物等であっても良いことは言うまでもない。

【００２７】

【発明の効果】上述のように、本発明の無人搬送車システムの安全装置は、作業者の所持する携帯端末が、作業者の移動を検知して、作業者が移動中である間のみ作業者と無人搬送車との距離判別を行って無人搬送車の走行制御を行うので、作業者が静止中は無人搬送車の障害物センサーにより作業者と無人搬送車との衝突を回避することとなり、作業者の携帯端末による無人搬送車の余計な走行制御を減らすという効果がある。また、作業者が静止中は携帯端末が動作しないので携帯端末の動作寿命を長くすることができるという効果もある。

【図面の簡単な説明】

【図１】本発明の第１の実施形態の無人搬送車システムの安全装置を示すブロック図である。

【図２】本発明の第２の実施形態の無人搬送車システムの安全装置を説明するための作業フロアーを示す上面図である。

【図３】本発明の第２の実施形態の無人搬送車システムの安全装置を示すブロック図である。

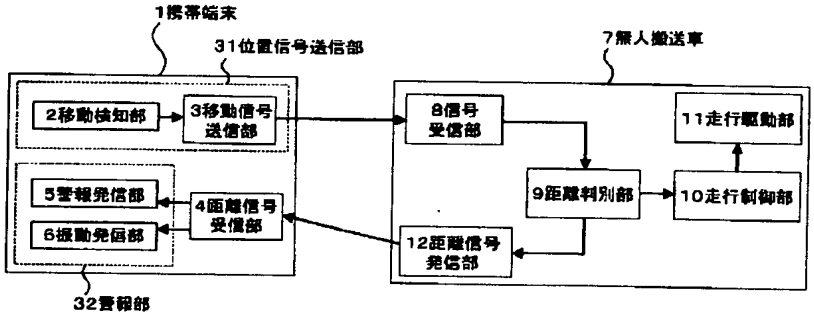
【図４】従来の無人搬送車システムを説明するための見取図である。

【図５】従来の無人搬送車システムの安全装置を示すブ＊ロック図である。

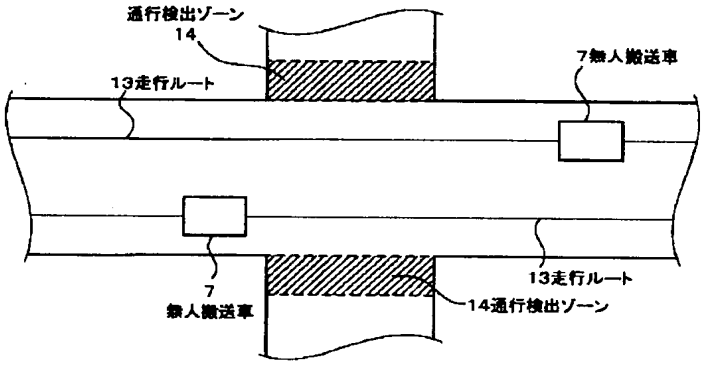
【符号の説明】

１　携帯端末
２　移動検知部
３　移動信号送信部
４　距離信号受信部
５、４５　警報発信部
６　振動発信部
７　無人搬送車
８　信号受信部
９　距離判別部
１０、５０　走行制御部
１１、５１　走行駆動部
１２　距離信号発信部
１３　走行ルート
１４　通行検出ゾーン
１５　通行検出ゾーン検知部
１６　通過信号送信部
３１、３３　位置信号送信部
３２　警報部
５６　電波発信装置
５７　ベルト
５８　移動体
５９　電波受信装置
６０　作業者

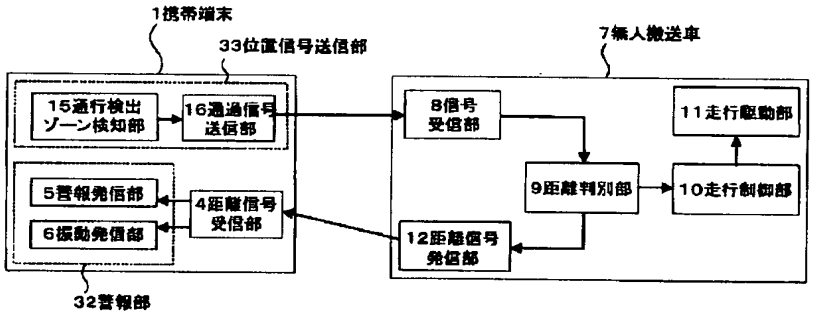
【図１】



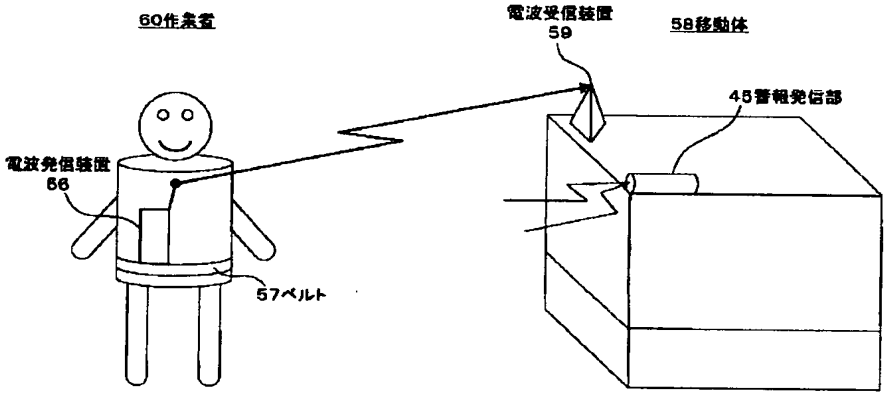
【図２】


通行検出ゾーン
14
7無人搬送車
13走行ルート
7
無人搬送車
13走行ルート
14通行検出ゾーン

【図３】


1携帯端末
33位置信号送信部
7無人搬送車
15通行検出
ゾーン検知部
16通過信号
送信部
8信号
受信部
11走行駆動部
9距離判別部
10走行制御部
5警報発信部
6振動発信部
4距離信号
受信部
12距離信号
発信部
32警報部

【図４】


60作業者
電波受信装置
59
58移動体
45警報発信部
電波発信装置
56
57ベルト

【図５】